THE University of Bristol has made the following appointments to the professorial chairs mentioned: *Botany:* Dr. Otto Vernon Darbishire, lecturer in botany in the university. *Education:* Dr. Helen Marion Wodehouse, principal of the Bingley Training College, Yorkshire. *Henry Overton Wills Chair of Mathematics:* Dr. H. Ronald Hassé, late fellow of St. John's College, Cambridge; senior lecturer in mathematics in the University of Manchester. *Mechanical Engineering:* Major Andrew Robertson. *Henry Overton Wills Chair of Physics:* Dr. Arthur Mannering Tyndall, acting head of the department of physics in the university during the war. *Henry Overton Wills Chair of Physiology:* Dr. George A. Buckmaster, assistant professor of physiology in the University of London.

DISCUSSION AND CORRESPONDENCE

TANDLER AND KELLER ON THE FREE-MARTIN[1]

IN April, 1916, the writer published a short article on "The Theory of the Free-Martin"[2] in which he sought to demonstrate that contrary to the then prevailing opinion the free-martin is a female, and that its intersexual condition is due to early embryonic anastomosis of the blood vessels of its chorion with those of the male twin, with consequent inversion, more or less complete, of the internal organs of reproduction by action of the testicular homones of the male. A detailed account of the data and theory was published in the *Journal of Experimental Zoology* in 1917.[3] At the time of publication the writer supposed that both the data and theory were new, but he has learned this summer by a reference in a work of Magnusson[4] that some of the data at least were anticipated by Tandler and Keller in a publication dating from 1911.[5]

These writers studied seventeen pairs of two-sexed cattle twins in fœtal stages and determined the following fundamental facts:

1. That such twins have a common chorion.

2. That branches of the umbilical vessels, especially the arteries, anastomose by relatively large branches, so that an injection from an umbilical artery of one fœtus would pass over into the umbilical arteries of the other. The females of such pairs possessed the typical "hypoplastic genitals" of the free-martin.

3. In one case, in which there was no macroscopic vascular anastomosis in the chorion and the injection would not pass over, both male and female possessed normal reproductive organs. The authors consider this more than a mere matter of chance.

4. That the maternal ovaries possess two corpora lutea, usually one in each ovary; hence they correctly interpret the twins as dizygotic.

5. The youngest pair of twins examined had a neck-rump measurement of 21 cm.; the female was typically malformed. Hence the origin of the condition is earlier.

From these facts the authors conclude that "vascular relationships and genital development stand in some kind of etiological relationship."

The writer independently stated all of these facts in his 1916 paper, and in addition the following facts and considerations:

1. A comparison of sex ratios of the four kinds of twins ♂♂, ♀♀, ♂♀, ♂♀, demonstrating from the statistics that the sterile free-martin must be zygotically female.

2. A study of much earlier stages than the youngest of Tandler and Keller showing that the union of chorions is secondary and that it probably occurs at or about the time of beginning sex-differentiation (20–25 mm.).

3. A statement of conditions of the fœtal membranes in twins of sheep, showing that, though the membranes fuse, no macroscopic

[1] To the kindness of Professor A. Lipschütz, of Berne, the writer owes a reference to a later and presumably more complete account of the investigations of the same authors (*Wiener Tierärzlitche Wochenschrift*, III., Jahrgang, Heft 12, 1916), which however he has not yet seen.

[2] SCIENCE, N. S., XLIII., pp. 611–613.

[3] Vol. 23, pp. 371–452.

[4] *Arch. f. Anat. u. Physiol., Anat. Abt.*, 1918, pp. 29–62.

[5] *Deutsche tierärztliche Wochenschrift*, 19 Jahrgang, 1911, pp. 148–149.

vascular anastomosis develops and the female of two-sexed pairs is normal.

4. A brief description of some of the outstanding features of the anatomy of the reproductive system of fœtal free-martins.

5. A complete statement of the homone theory.

The writer regrets that he should have overlooked such an important contribution as that of Tandler and Keller. Its publication in a journal practically unknown to American biologists, and the fact that no reference to it was found in any of the other literature on the subject until after the war explains the occurrence. The writer's interest in the subject arose originally from the birth of free-martins in his own herd of cattle (from 1909 on); thus brought into immediate contact with the subject he realized its great biological significance and first took up its serious study in 1914. Proximity to the Chicago stockyards from which material could be secured in abundance was another inciting cause to its study.

The main, and very satisfactory, feature of the situation is, however, that the fundamental facts have now been determined from two entirely independent series of investigations, at least to the extent indicated, and that all doubt as to the general cause of this remarkable phenomena must consequently vanish.

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THE ANTISCORBUTIC PROPERTIES OF RAW LEAN BEEF

Recent publications of Chick and Hume, Hess and Unger, Givens and Mendel, Cohen and Mendel, Harden and Zilva and others have contributed much to our knowledge of the etiology of scurvy and the antiscorbutic properties of food materials. It is quite generally agreed that normal development and well-being in animals are dependent upon certain accessory food factors, known as vitamines, of which there are, at present, three types: (*a*) fat-soluble A, a growth-promoting vitamine, the absence of which produces xerophthalmia and possibly other pathological conditions, (*b*) water-soluble B, a growth-promoting vitamine, the absence of which produces polyneuritis, and (*c*) the antiscorbutic substance, found in certain food materials, which Drummond[1] has named "water-soluble C."

Stefansson[2] in observing three cases of scurvy in his polar expedition, states that meat, and especially raw meat, prevented and cured scurvy while those of the party who subsisted, from choice, on carbohydrates, casein, cereals and a small amount of cooked meat, became afflicted with the disease.

This is not in agreement with the work of Chick, Hume and Skelton[3] or Pitz[4] for the former were unable to prevent the onset of the disease (in guinea pigs) by the administration of meat juice, while the latter made the same observation except that the administration of dry meat to the oats-milk diet delayed the onset of symptoms. Pitz attributes this to the better plane of protein intake, but we are inclined to believe that this is not the case, for he states that milk was fed *ad libitum* and it is generally agreed that the antiscorbutic properties of milk are proportional to the amount of milk ingested. We are also of the belief that those animals, described by Pitz, which showed improvement when fed meat and salt mixtures, drank more milk on account of the stimulation of thirst, with the result that the symptoms were delayed due to the increased amount of milk ingested.

We have found that, not only must the amount of milk fed in experimental scurvy be carefully controlled, but the diet of the cow is also a very important factor. We shall soon publish data to show that guinea pigs fed on oats and 20 c.c. of "spring milk" (daily) from cows fed on green grass and a

[1] Drummond, J. C., *Lancet* (Lond.), CXCV., No. 4963, No. XV. of Vol. II., p. 482, 1918.

[2] Stefansson, V., *J. Am. Med. Assn.*, Vol. 71, No. 21, p. 1715, 1918.

[3] Chick, H., Hume, E. M., and Skeleton, R. F., *Biochem. J.*, Vol. XII., Nos. 1 and 2, p. 136, 1918.

[4] Pitz, W., *J. Biol. Chem.*, Vol. XXXVI., p. 439, 1918.